Wayfair Supply Chain Analytics

Inventory Replenishment & Risk Management

Team 12, Bentley University

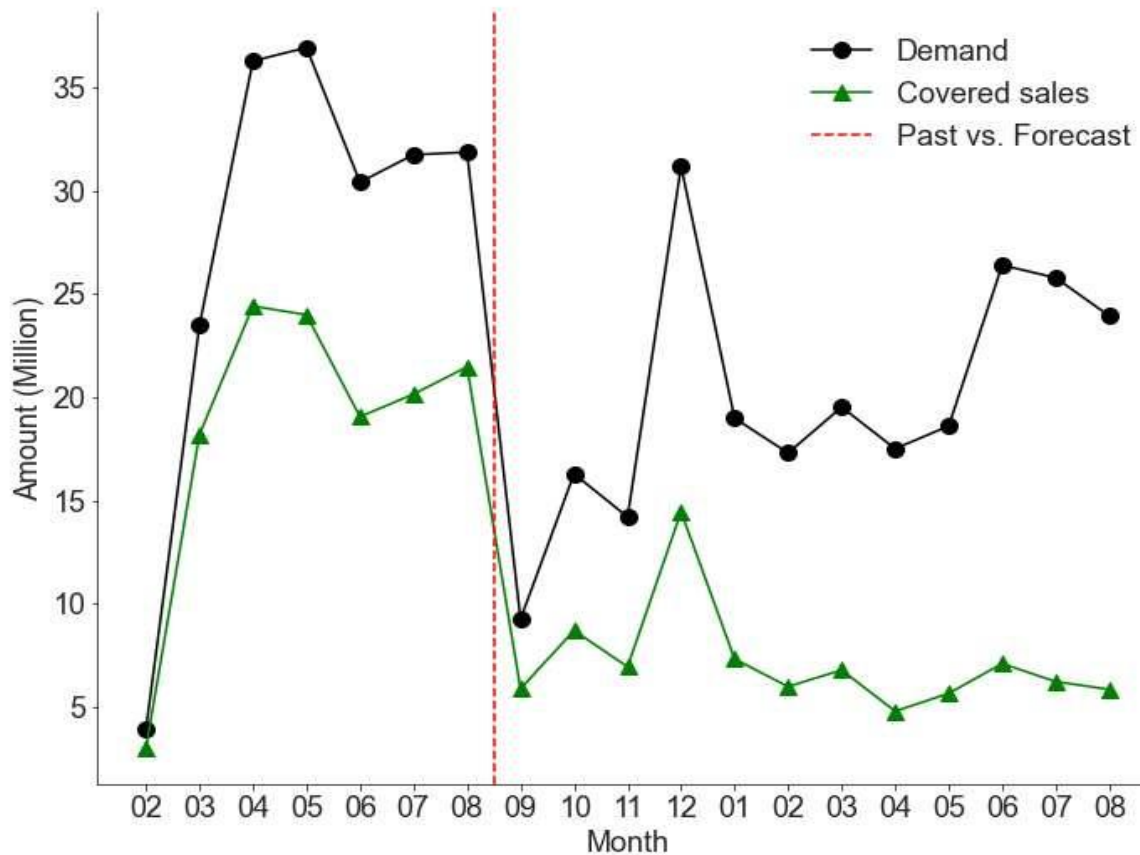Chen Ling, Han Wu, Jianyi Liao, Xiaoshuang Liu (Leader)

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01 Define Problems

Define Problems

Demand and Covered Sales Trend in the US Marketplace

01 **Low average coverage percentage: 3.2%**
Over 100 thousand undersupplied SKUs per month.

02 **Manufacturing and logistical limitation**
Placing orders that exceed suppliers' capacity is not practical, especially for top demand products.
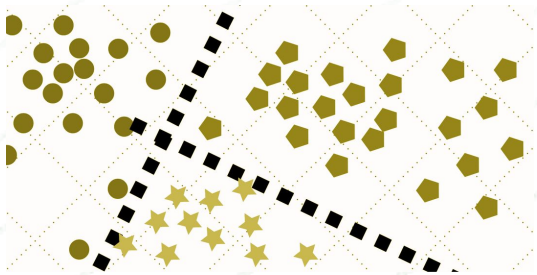
03 **Supplier diversification issue**
A heavy reliance on first-tier suppliers is dangerous.

How can we improve coverage% and control supply chain risks efficiently?
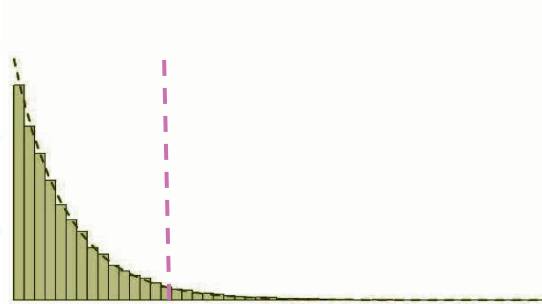
Solve Problems in 3 Steps

Replenishment & Substitution Pool

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Priority & Substitution Strategies

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Supplier Management

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- Distinguish replenishment pools in short-term & long-term to lower the manufacturing and logistical risk.
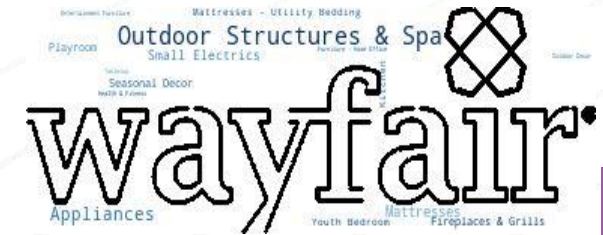
- Create a substitution pool from overstock SKUs.

- Build a Priority Score model , considering date, missed sale, missed count, and shipment type.

- Sort monthly SKUs by Priority Score, and obtain monthly prioritized SKU list by finding the tipping point.

- Substitute overstock SKUs for unselected low priority SKUs.

- Provide supplier management suggestions for different types of suppliers.

- Find potential supplier risks and provide outreach strategy.

02 Replenishment & Substitution Pool

Factors Affecting Efficiency

- **Wholesale Cost**

Higher wholesale cost indicates higher complexity in manufacturing and longer time to satisfy demand.

- **Demand Quantity**

More time is needed to fulfil high demand SKUs. Low demand SKUs are not allowed by batch manufacturing.

- **Shipment**

Size of parcel determines logistics efficiency.

Night table	Crib	Dresser
$80	$100	$120

Chest of drawers	Bunk beds
$120	$150

* "The lead time will depend on the materials used and how and where it will be made, but will usually take between **6 to 10 weeks**."

Solution: Create Different Replenishment Pools

"lower manufacture and logistic risks"

August 2020

short-term pool

November 2020

long-term pool
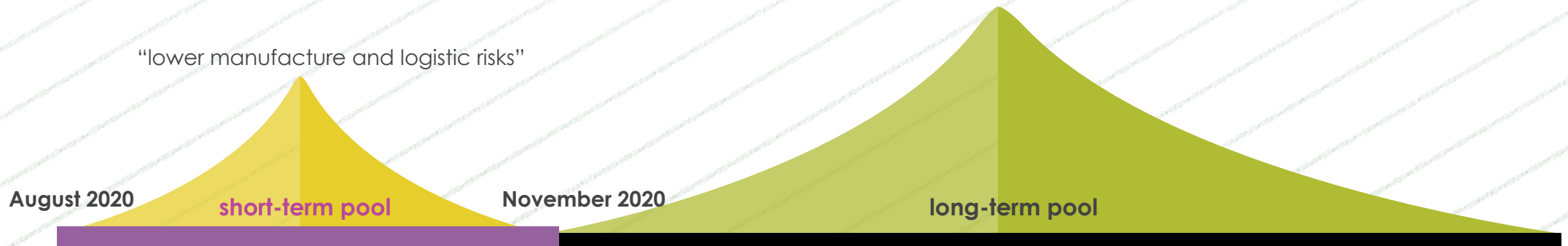
Create Replenishment & Substitute Pool

Replenishment Pool

- **Short-term**

  ➤ Sep 2020 - Oct 2020 SKU selection pool

  ➤ Group category by wholesale cost: high, medium, low.

  ➤ Shrink **excess forecast demand** for high and low groups based on predicted maximum manufacture capacity.
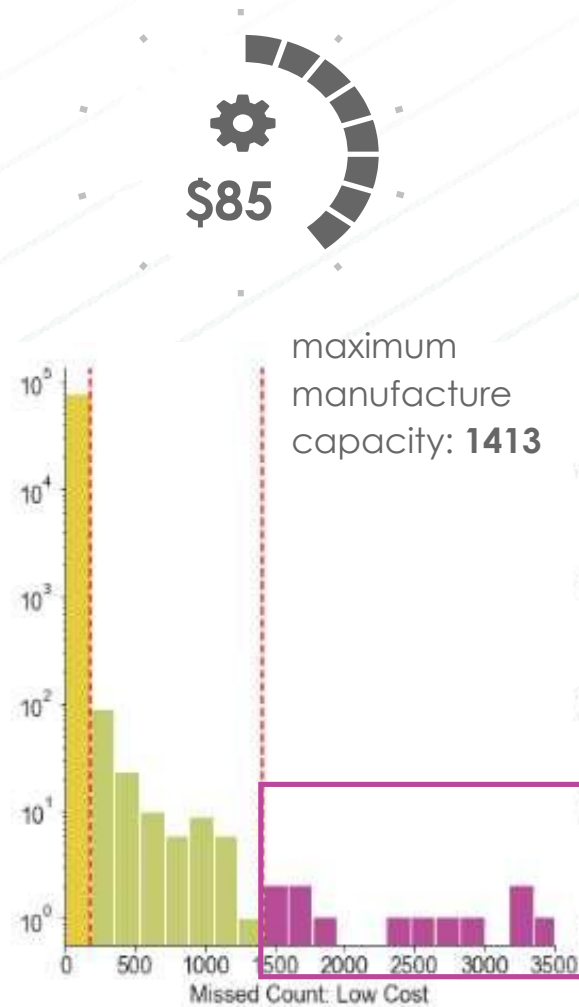
  ➤ Drop **low demand SKUs**.

- **Long-term**

  ➤ Nov 2020 and afterwards SKU selection pool.

  ➤ Drop **low demand SKUs**.

Substitute Pool

  ➤ Use overstock SKUs as substitution.

Low Cost Categories

$85

maximum manufacture capacity: **1413**

Missed Count: Low Cost

High Cost Categories

$151

maximum manufacture capacity: **422**

Missed Count: High Cost
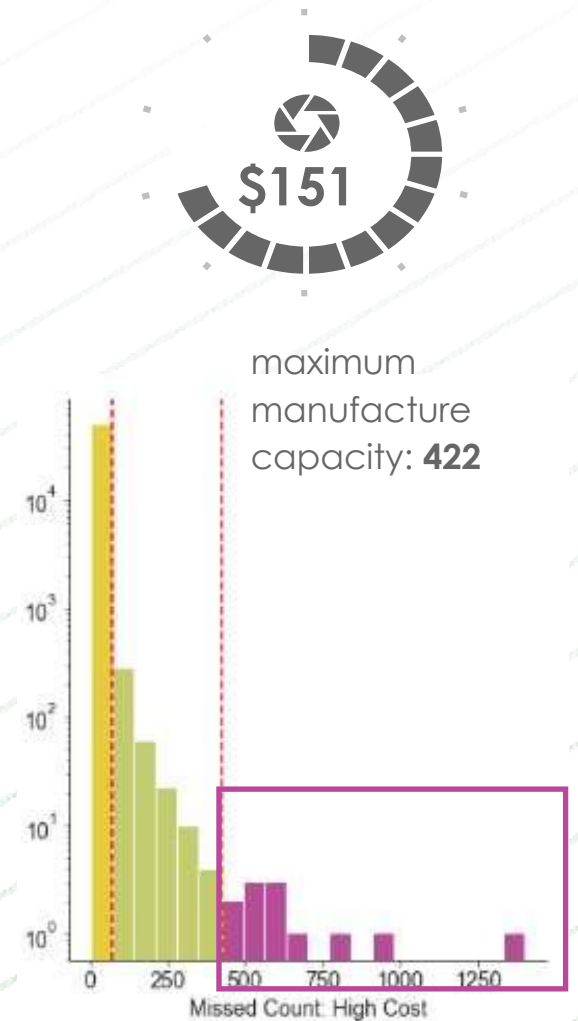
03 Priority & Substitution Strategy

Priority Strategy: SKU

- **Priority Score = (Missed Sales + Adjusted Demand * 100) * Parcel Effect**
 - ➢ Missed Sales: larger missed sales make greater contribution to fill the gap.
  - ➢ Adjusted Demand:
    - ✓ Give weight to high demand but low missed sales products.
    - ✓ Demand = Missed Sales / Wholesale Cost, an indicator of actual demand.
    - ✓ Why adjusted: Take production limitation into account.
  - ➢ Parcel Effect : 1.5 for small parcels in short term period, 1 for all others.
- **Customize monthly prioritized SKU list by finding the tipping point.**

prioritized top 14% SKU ➡ **monthly average covered sales increase to 83%**
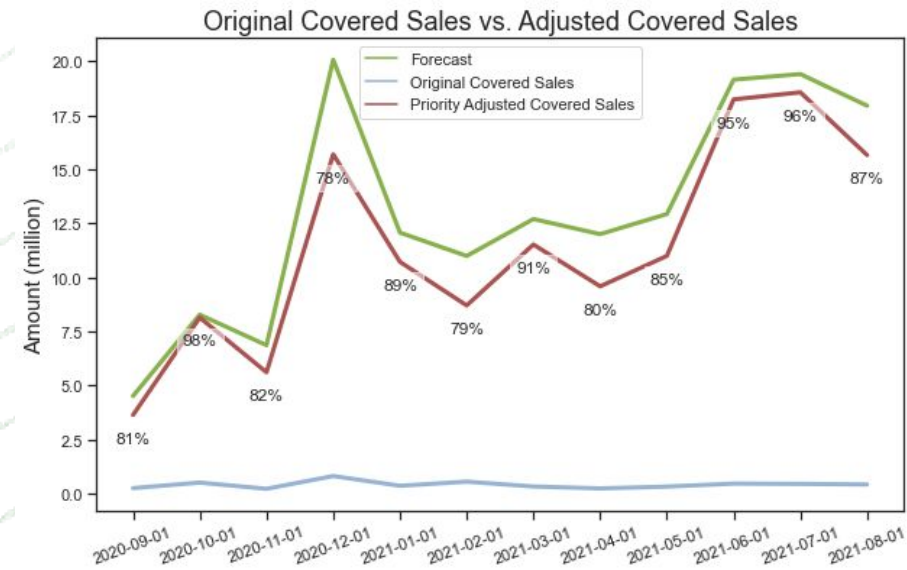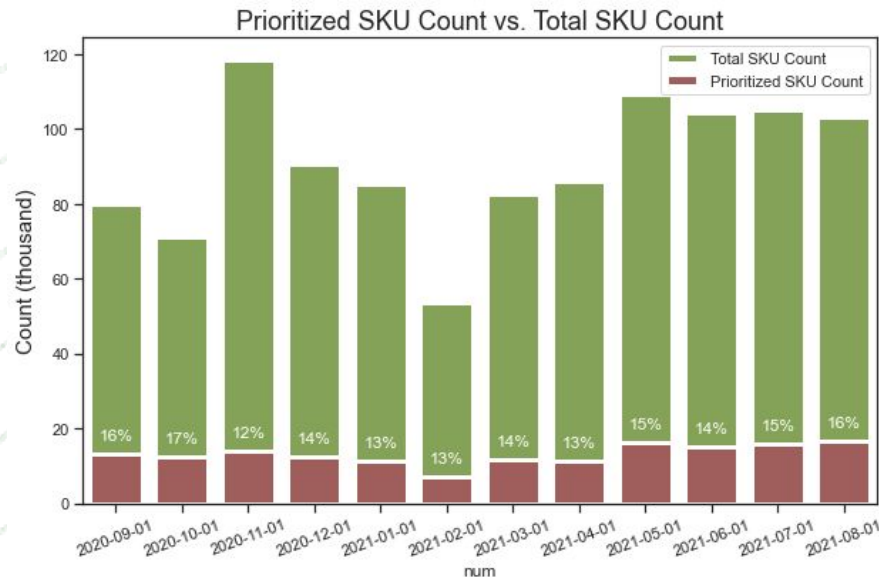
Priority Strategy: Category

Based on monthly prioritized **SKU list**, identify prioritized **Category list**.

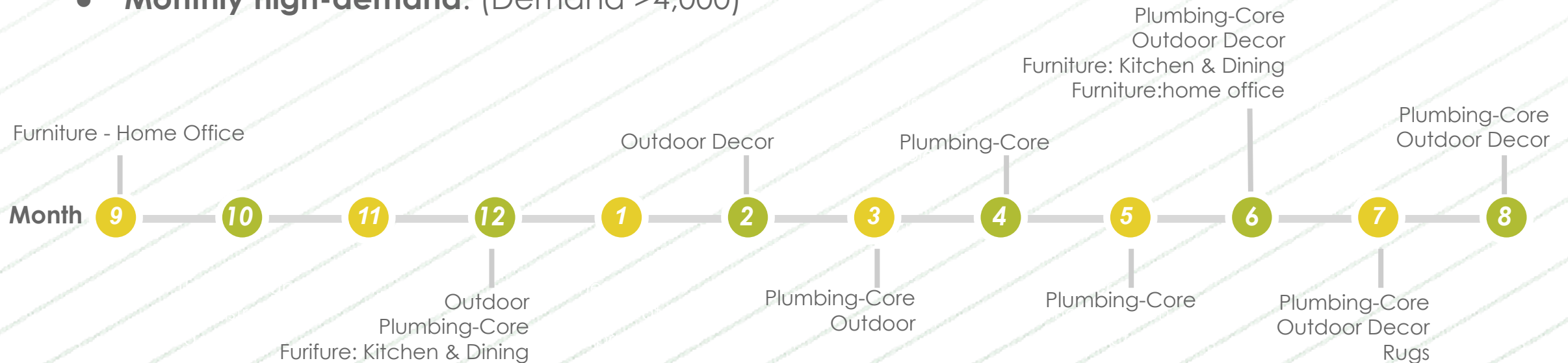- **All-time high-missed-sale high-demand** (Missed Sale > 1M, min Demand > 2,000)

Outdoor Structure & Spa	Appliance	Fireplace & Grill	Seasonal Decor	Storage & Org	Lighting	Furniture-Home Office

- **Monthly high-demand**: (Demand >4,000)

Month

| 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |

Month 9: Furniture - Home Office

Month 11: Outdoor / Plumbing-Core / Furifure: Kitchen & Dining

Month 2: Outdoor Decor

Month 3: Plumbing-Core / Outdoor

Month 4: Plumbing-Core

Month 5: Plumbing-Core

Month 6: Plumbing-Core / Outdoor Decor / Furniture: Kitchen & Dining / Furniture:home office

Month 7: Plumbing-Core / Outdoor Decor / Rugs

Month 8: Plumbing-Core / Outdoor Decor

Substitution Strategy

Substitute overstock SKUs for low priority undersupply SKUs

Overstock:
71,460 SKUs
495,283 records

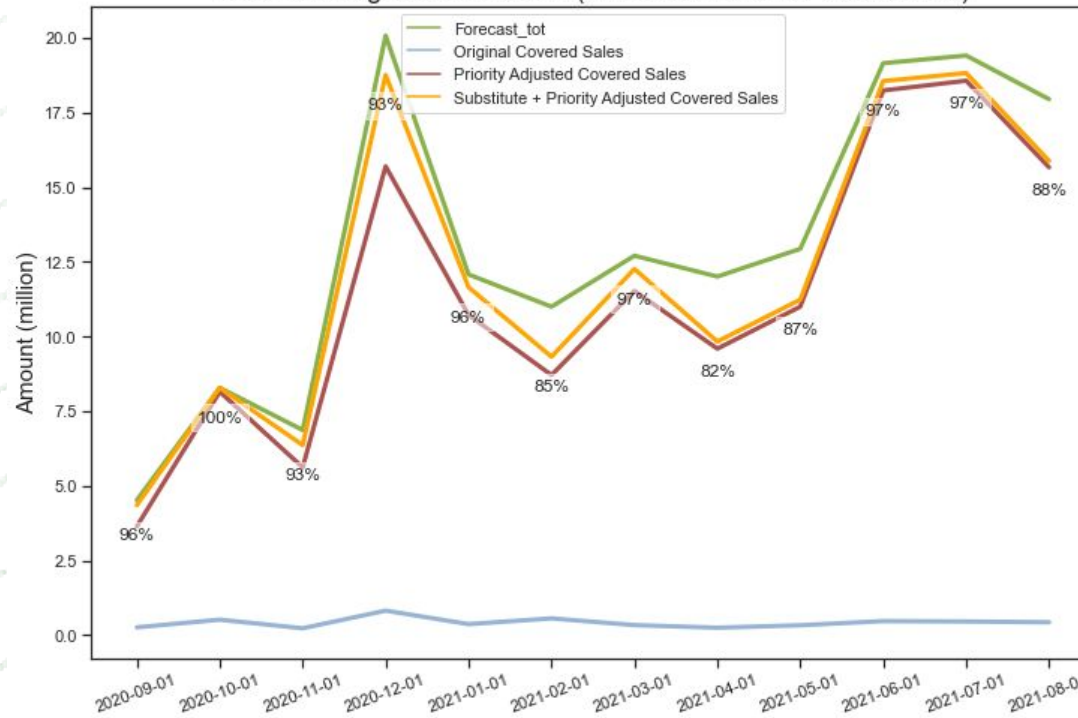**Filter**

Overstock > $50

6,024 SKUs
20,178 records

Match

Same item class
Same month
Wholesale cost within range:
0.5-2x

Undersupply:
140,704 low priority SKUs
972,659 records

Total Coverage Increasement (Prioritized SKU list + Substitute)

Legend:
- Forecast_tot
- Original Covered Sales
- Priority Adjusted Covered Sales
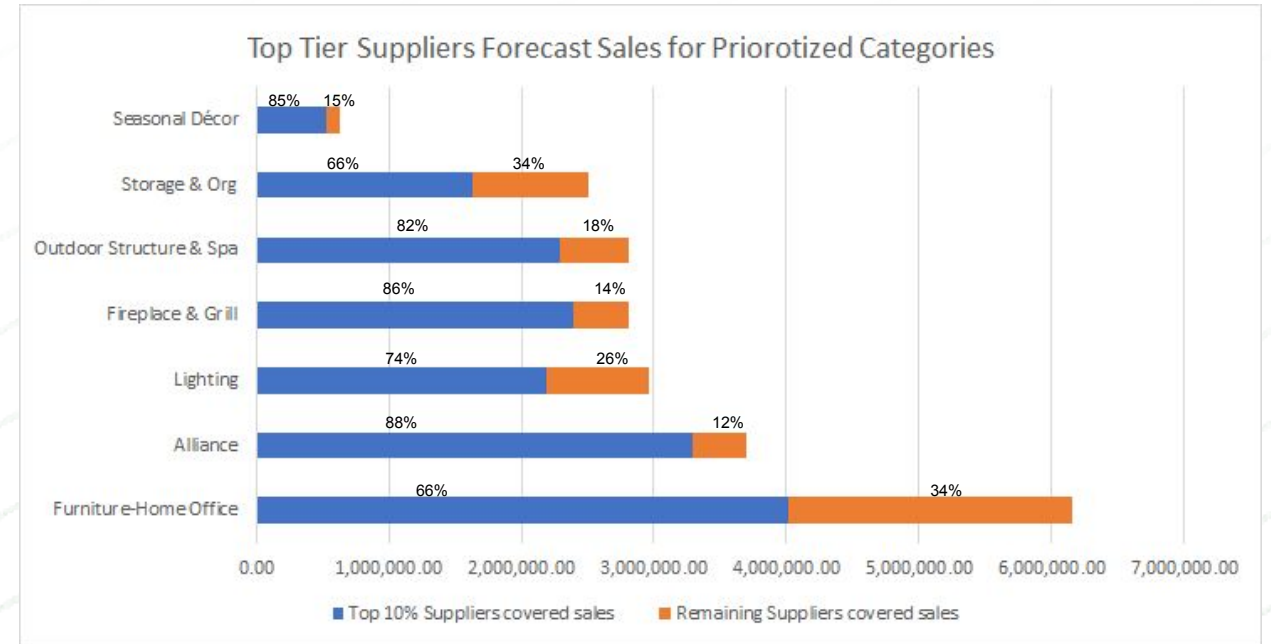- Substitute + Priority Adjusted Covered Sales

Result

- Most SKU matched, only 3.4% (17,112 records) overstock inventory left.

- Maximum potential average coverage percentage increase is **9.6%** , from **83%** to **92.6%**.

04 Supplier Management

Supplier Risk

- **Overall:**

  Top **2**% suppliers are responsible for **48.49**% of sales.

- **Prioritized Categories:**

  "Don't Let Your Supply Chain Control Your Business!"

- **Recommendations:**

Top Tier Suppliers Forecast Sales for Priorotized Categories

Category	Top 10% Suppliers covered sales	Remaining Suppliers covered sales
Seasonal Décor	85%	15%
Storage & Org	66%	34%
Outdoor Structure & Spa	82%	18%
Fireplace & Grill	86%	14%
Lighting	74%	26%
Alliance	88%	12%
Furniture-Home Office	66%	34%

■ Top 10% Suppliers covered sales ■ Remaining Suppliers covered sales

Large Suppliers
✓ Maintain relationsihip
✓ Give enough product prepare time

Small Suppliers
✓ Target Best performance
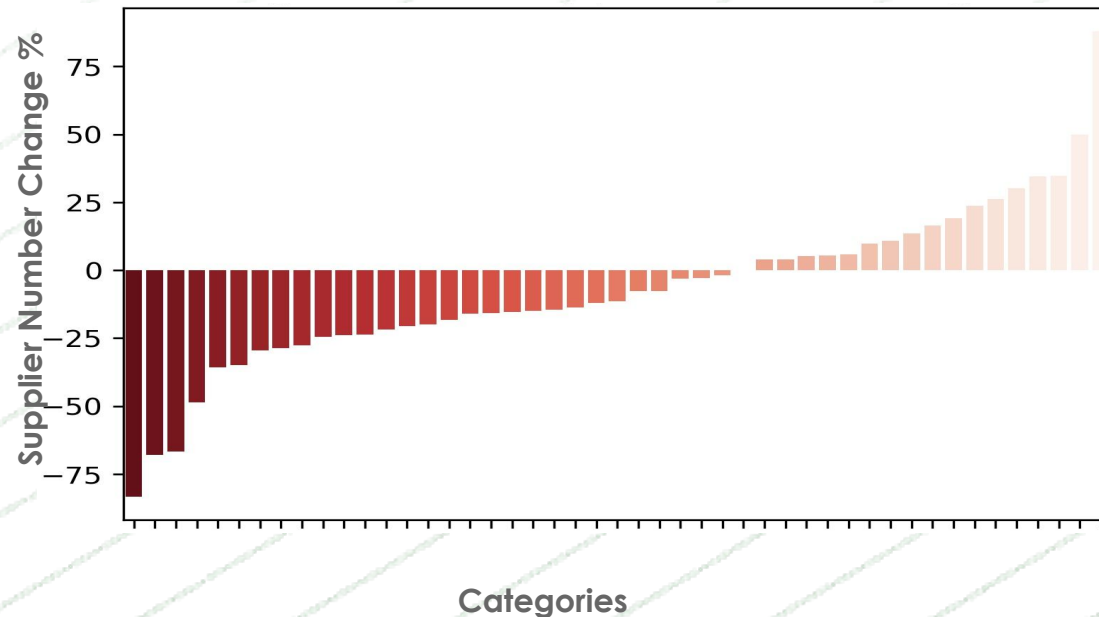✓ Improve conversion rate

General Suggestion
✓ Outreach to more suppliers

https://hbr.org/2011/12/dont-let-your-supply-chain-control-your-business

Supplier Outreach Strategy

01 **The change of supplier numbers over time**

$Change\% = (N_{future} - N_{past}) / N_{past} * 100$

➢ Where N refers to number of unique suppliers in each category.
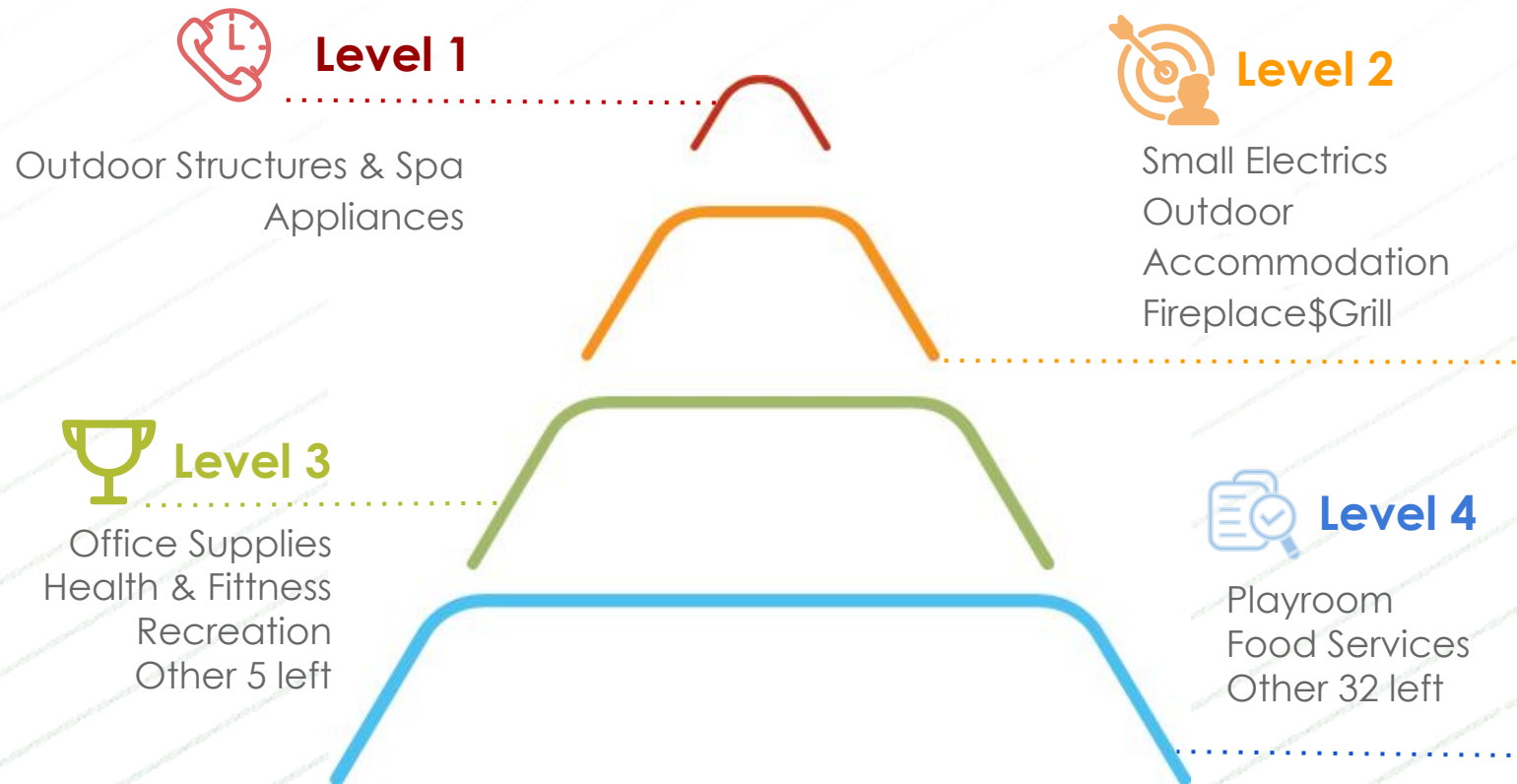
➢ **Result:**

02 **Ranking Model**

Ranking Metrics = Priority Score * Change%

➢ Priority score：measures the importance of each category.

➢ Change%：reveals necessity of outreaching to new suppliers.

03 **Hierarchy of Categories**

➢ Identify **4** levels of categories.

Hierarchy of Category

Level 1

Outdoor Structures & Spa
Appliances

Level 2

Small Electrics
Outdoor
Accommodation
Fireplace$Grill

Level 3

Office Supplies
Health & Fittness
Recreation
Other 5 left

Level 4

Playroom
Food Services
Other 32 left

Findings

- For Outdoor Structures & SPA category, average decrease of number of suppliers on **accessories** is over **50%**, higher than other item classes.
- For Outdoors category, number of supplier decreases in **ALL** 26 item classes are larger than **10%**.
- For Office Supplies category, number of suppliers decreases **50%**, number of item class decreases from **20** to **1.**

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05 Conclusion

Conclusion

Maximize coverage% , lower risks !

Inventory Replenishment

➢ Create replenishment and substitution pools.

➢ Consider risk in lead time in recent replenishment.

➢ Trigger proposal on priorized SKUs (top **14**%) will bring an average **83**% coverage.

➢ Substitute overstock SKUs for low priority undersupply SKUs will lead to an additional maximum **9**% increase.

Supplier Management
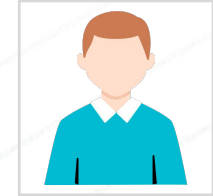
➢ Form close ties with first tier vendors.

➢ Maintain direct tie with selective small suppliers.

➢ Outreach to new suppliers.

➢ Put limited resources on influential categories (e.g. Level 1 & 2) and item classes to diversify suppliers.

Future study

➢ Forecast error range

➢ Economic uncertainty and structural change

Thank You!